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UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	Chan, *et al.*
Serial No.:	09/757,364
Filed:	January 8, 2001
For:	Method for Joining Large Substrates
Examiner:	John T. Harlan
Art Unit:	1733
Att'y Dkt.:	02EK-104742

CERTIFICATE OF MAILING/TRANSMISSION (37 C.F.R. § 1.8A)

I hereby certify that this correspondence is, on the date shown below, being:

(X) deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Mail Stop Fee-Amendment, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450

( ) transmitted by facsimile to the Patent and Trademark Office.

9-17-03 Jordan Wilson
Date Jordan Wilson

DECLARATION OF ALBERT W. CHAN UNDER 37 C.F.R. §1.131

1. I, ALBERT W. CHAN, residing in San Jose, California, am one of the inventors of the invention of "Method for Joining Large Substrates," which was filed as U.S. Patent Serial Number 09/757,364 on January 8, 2001 (the '364 application).

2. Prior to September 21, 2000, my co-inventors and I had reduced the invention claimed in the '364 patent application to practice within the United States.

3. Attached hereto is an Exhibit of a copy of the original Invention Disclosure which formed the basis for the '364 application (the invention).

4. The dates contained in the original Invention Disclosure are blocked off, but all are prior to September 21, 2000.

5. The method claimed in the '354 application is recited in section IV.1 of the attached Invention Disclosure as having the purpose of joining large area substrates using a liquid polymer. The steps of the method are recited in section IV.2. of the attached Invention Disclosure as including dispensing liquid polymer at specified locations on a substrate, contacting an opposing substrate to contact the polymer, forcing the substrates together to squeeze the polymer over the surfaces, and curing the polymer.

6. As stated in section IV.6 and V.2 of the attached Invention Disclosure, the method was

applied to the joining of 6 inch by 6 inch substrates and laminate boards, and thus the invention worked for its intended purpose.

7. As described in Paragraphs 4 through 6, the attached Invention Disclosure establishes that the invention was reduced to practice and worked for its intended purpose prior to prior to September 21, 2000.

8. We have attempted to locate additional corroborating evidence in the form of pertinent documents, specifically pages of laboratory notebooks documenting the conception of invention, laboratory records, and monthly reports documenting the reduction to practice of the invention. However, these pertinent documents are not reasonably obtainable despite repeated attempts to locate them. The reason the records are difficult to locate is that the company at which I was employed at the time the invention was reduced to practice, Fujitsu Computer Packaging Technologies, Inc., was dissolved on or about October 2000. Some of the pertinent documents were destroyed, and the remaining were dispersed between Fujitsu Limited, Fujitsu America, Inc. (FAI) and Fujitsu Laboratories of America (FLA). I have contacted representatives at all three companies in an attempt to obtain these documents. However, my contacts, as of the date of this declaration, have not been able to locate any of these materials.

9. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

September 15, 2003

Albert W. Chan

Albert W. Chan

Fujitsu

Fujitsu Computer Packaging Technologies, Inc.

Record and Disclosure of Invention

I. INVENTOR

Be it known that

Albert W. Chan
7308 Rainbow Drive, #16
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Mark Thomas McCormack
743 Pine Avenue
San Jose, CA 95125

Michael G. Lee
6064 Sage Oak Way
San Jose, Ca. 95120

Solomon I. Beilin
83 Club Drive
San Carlos, CA 94070

II. NAME OF DISCLOSURE

Conceived the invention illustrated and described within this record of invention document on _____, which is called:

Large Area Substrate Joining

Signatures of Inventors

Albert W. Chan _____

_____ _____

_____ _____

_____ _____

This invention was disclosed to the following people, who have read and fully understand the construction and use thereof:

[1] Tom Mahoney _____ _____

[2] _____ _____

III. ILLUSTRATIONS

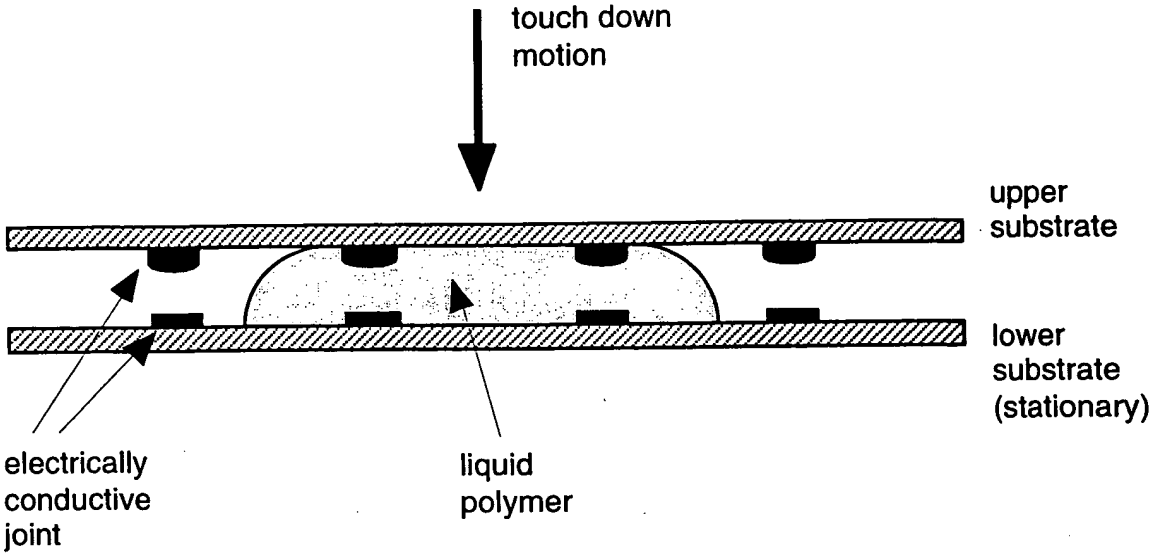

Figure 1. Squeeze Flow During Substrate Joining.

Figure 2. Substrate After Joining.

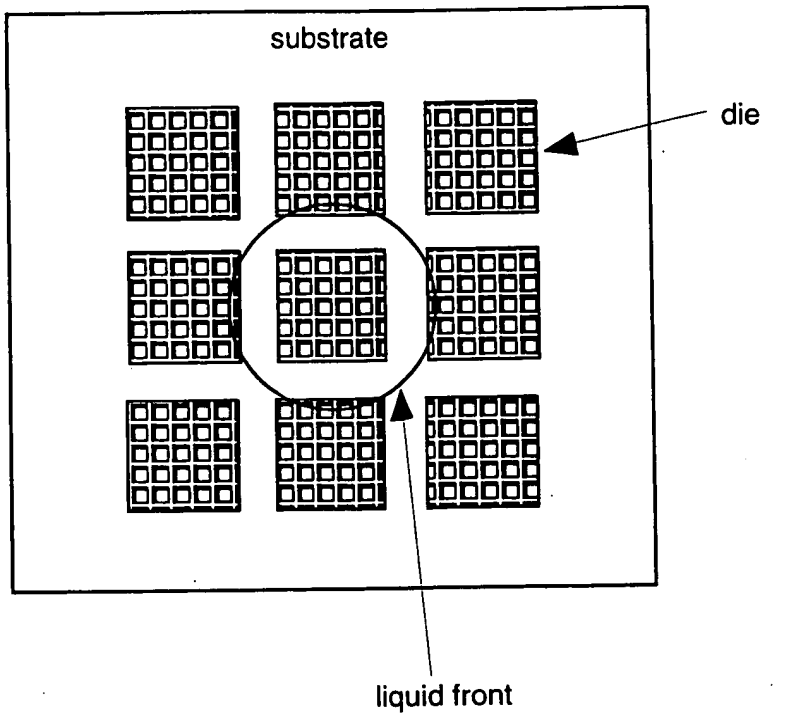

Figure 3. Dispensing Polymer at Substrate Center.

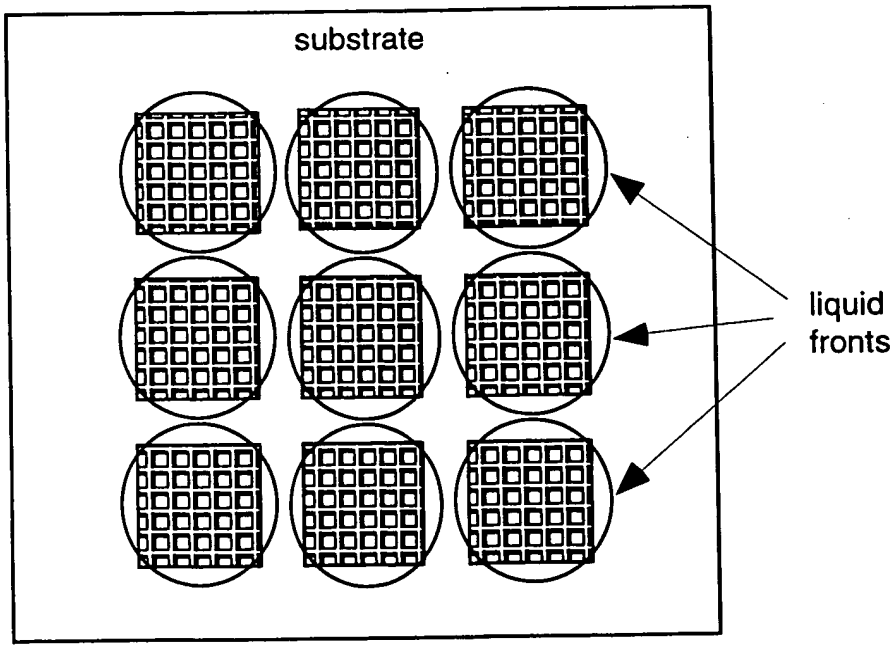

Figure 4. Dispensing Polymer at Each Die.

IV. DESCRIPTION OF INVENTION

1. Purpose / Goal / Use

The goal in this invention is a process for joining large area substrates using a liquid thermoset polymer.

2. Details of the Configuration / Function / Process

As depicted in Figure 1, a measured amount of liquid polymer is dispensed at specified location or locations on the lower substrate. The upper substrate is lowered onto the lower substrate, during which it comes in contact with the dispensed polymer and forces it to move outwards through squeezing flow. At completion of substrate joining, the joined assembly goes through a heating cycle to form the electrically conducting joints and to cure the polymer. As shown in Figure 2, the polymer is an integral part of the joined assembly. The polymer performs several functions, including:

- semi-hermetic seal for electrically conducting joints and circuitry on substrate surfaces,
- stress relief during service, when temperature fluctuations can lead to stresses from coefficient of thermal expansion mismatch among components in the substrate assembly, and
- dielectric layer for isolating electrical signals between substrate circuitry.

The polymer can be dispensed at the center region of the substrate, as shown in Figure 3, or it can be dispensed individually at each die center, as shown in Figure 4. When dispensed at the substrate center, the polymer flows outward with a single flow front. For multiple point dispensing, a flow front exists for each dispensing location, which may eventually merge and form fewer flow fronts. Air bubbles may be entrapped when flow fronts merge and joining is done at ambient conditions. Joining under a vacuum environment can eliminate entrapped air bubbles. Single point dispensing is useful for smaller substrates, while multiple point dispensing offer better flow control over each die region in joining of very large area substrates.

The polymer composition must meet several requirements for the substrate joining process to work, including:

- very low levels of ionic contaminants (known art in the electronics industry),
- low viscosity so it can flow around features on both substrates,
- will not gel before electrically conductive joints are formed, and
- after postcure, exhibit low dielectric constant, high temperature performance, good adhesion to substrate surfaces and components, and low moisture absorption.

In addition, the polymer composition should also:

- flux oxides at metal surfaces,
- remove water generated from fluxing of oxides,
- immobilize ionic species from fluxing of oxides, and
- allow for modification of coefficient of thermal expansion as needed.

3. Advantages of the Invention (List and Explain)
This invention provides a simple approach to joining of large area substrates. Conventional underfill process for flip chip to substrate joining is limited to very small joining areas (typically 1-inch by 1-inch area or less). Substrate buildup is expensive compared to the simpler approach described in this invention. Joining of similar or different substrate materials (i.e., flexible substrates, rigid wafers, and laminated circuit boards) can be performed without substantial process modification. The joining process can be automated for high speed, low cost joining of large area substrates.

4. Extensions
This invention can be extended to different materials, configurations and sizes.

5. Development Status
The approach in this invention has been tried on joining of 6-inch by 6-inch flexible to flexible substrates and 6-inch by 6-inch laminate board to flexible substrate.

6. Claims (Try, if possible)
The claim in this invention is a process and polymer composition for joining of large area substrates.

V. DOCUMENTATION

1. When was the invention first conceived?
The invention was first conceived in in connection with the ASO-EU Z-connection project.

2. When was the model first built, tested or demonstrated?
The first trial for ASO-EU flexible to flexible substrate joining with eutectic Sn/Pb solder was done on using an epoxy resin formulation for the polymer.

VI. PUBLIC DISCLOSURE, ETC.

1. Has the invention already been publicly disclosed or is it to be publicly disclosed in near future ?

_ Yes When? _____
By whom _____
x No

2. Has the invention already been placed in commercial use or is it to be placed in commercial use in near future?

_ Yes When? _____
By whom _____
x No

3. Has the invention already been offered for sale or is it to be offered for sale in near future?

_ Yes When? _____
By whom _____
x No

4. Has the invention already been described in printed publication or is it to be described in printed publication in near future ?

_ Yes When? _____
By whom _____
x No

VII. RELATED PATENTS

1. Patent / Date
   5128746 / July 7, 1992
   5376403 / December 27, 1994

VIII. PRIOR REFERENCES

IX. INVENTION ASSESSMENT

Please assess the merit of the invention in accordance with "INVENTION ASSESSMENT SHEET".